

ENERGY ENGINEERING ANALYSIS
PROGRAM STUDY REPORT

EXECUTIVE SUMMARY
FINAL REPORT

MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

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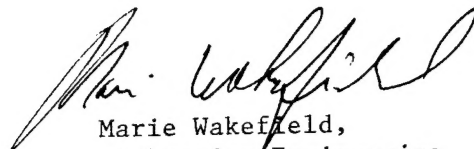


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EXECUTIVE SUMMARY

This is a summary of the Energy Engineering Analysis for the Milan Army Ammunition Plant (MAAP) in Milan, Tennessee. It includes the recommendations for the development of a Basewide Energy Plan consisting of energy conservation projects and other recommendations for reduction of the installation's 1985 source energy consumption.

Milan Army Ammunition Plant, containing 22,541 acres, is situated in both Gibson and Carroll Counties, Tennessee, and is approximately equally divided longitudinally into the two counties. Milan, Tennessee, is 5 miles west and has a population of 8,100; Humboldt is 17 miles southwest with a population of 10,200; Trenton is 18 miles northwest with a population of 4,600; and Jackson is 28 miles south with a population of 49,100. The Mississippi River is approximately 55 miles west of the plant, the Tennessee River 45 miles east.

Milan Army Ammunition Plant and the surrounding area is gently rolling terrain. The elevation of the plant varies from a high of approximately 590 feet on the south side, to a low of approximately 320 feet on the north boundary of the reservation. The Milan area experiences typically short mild winters and long warm summers. With the exception of a few modernized facilities, the overwhelming majority of buildings at MAAP were constructed for World War II ammunition production.

This Energy Engineering Analysis summary presents data on:

- Historical and predicted energy consumption
- Energy conservation procedures for distribution systems
- Energy conservation procedures for buildings and processes
- Utilization of energy monitoring and control systems (EMCS)
- Utilization of wood biomass
- Conservation procedures under higher levels of mobilization

The conservation of energy in existing facilities can be accomplished in two basic ways:

- Reduce the basic system energy requirements and source energy use
- Recover energy discharged from one user and utilize this waste energy for other purposes

A reduction in source energy requirements is represented by such activities as lowering equipment operating temperatures, reduction of transmission losses by better insulation, and night/weekend setback or shutdown of energy users and associated distribution systems.

Recovery of energy discharged by one user and utilization of this waste energy for other purposes is demonstrated by such activities as returning condensate to boiler systems and recovery of heat from process exhaust air systems to preheat replacement air. Examples of energy below the level of practical utilization are exhaust flue gases from boilers (cooled to near the dew point), and air exhausted from buildings near ambient temperature conditions.

This study has been directed towards identifying means of energy conservation conforming to those two methods identified as reduction in overall use and recovery of waste energy. Although the above discussion may appear to be confined to heat energy, investigations covered electrical usage, water usage, compressed air, wood biomass and solar energy.

The number and type of viable ECAM projects has been restricted by direction of the COE, Mobile to those which qualify at the 1980 level of mobilization (approximately 15%) and which exceed a Capital Cost Value of \$100,000. The total energy savings presented in this report can be obtained only upon full implementation of the viable ECAM projects and compliance with the recommended conservation measures requiring capital investments less than \$100,000. Those measures requiring policy changes at the management level, will result in additional savings.

Computer simulations of building energy use were modeled using the DOE-2.1 program. Computer simulations for energy utilization were performed on typical building types. Categorizing and prototyping methodology followed procedures outlined in the Black & Veatch Study "Engineering Instructions for Preparation of a Basewide Energy Systems Plan", dated January 1980. After careful examination of the MAAP facilities during field surveys, taking into consideration the building construction, building functions, and plant operating procedures, a total of 17 typical buildings were computer modeled to determine their energy use, both thermal and electrical, and to verify recorded historical energy consumption figures during the base year 1975. The final

analysis resulted in a correlation which was within 3 percent of recorded consumption figures.

Energy conservation projects were generated from the energy model for conservation measures involving building insulation, reduction in fenestration area, temperature controls installation, relighting with energy-efficient fixtures, and a basewide EMCS. A detailed analysis is provided in the main report.

The following is a tabulation of the MAAP source energy consumption for the fiscal years 1975 and 1980.

<u>Source</u>	<u>1975</u>	<u>1980</u>
Electricity	218,751 x 10 ⁶ BTU	126,226 x 10 ⁶ BTU
Fuel Oil No. 2 & 6	245,205 x 10 ⁶ BTU	107,153 x 10 ⁶ BTU
Coal	255,115 x 10 ⁶ BTU	124,841 x 10 ⁶ BTU

This yields a total of 358,220 Mega BTU's for FY-80 (see Figure 1) as compared to a total of 718,891 Mega BTU's for FY-75. It is reported that operations during this period had decreased from an average level of 37% mobilization in FY 1975 to an average level of 15% mobilization in FY-1980.

Figure 2 shows the historical and predicted annual energy consumption for a ten-year period through fiscal year 1986, reflecting the effect of proposed conservation measures.

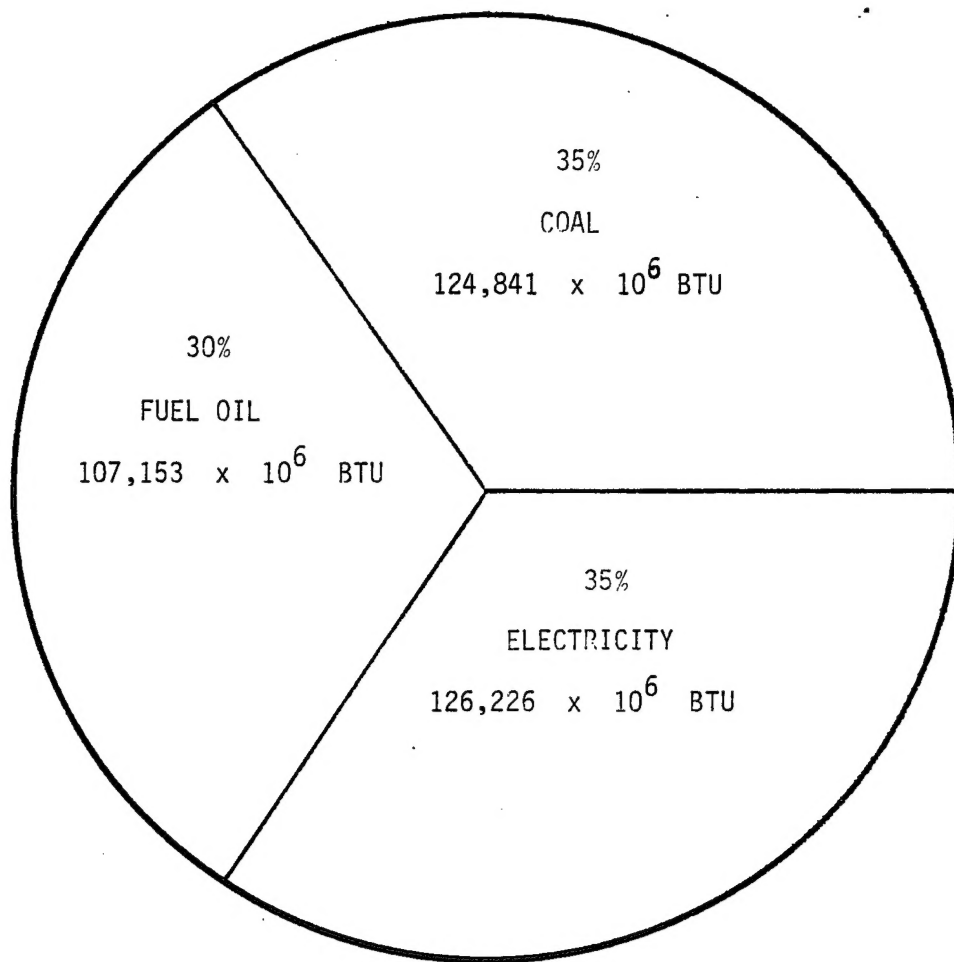


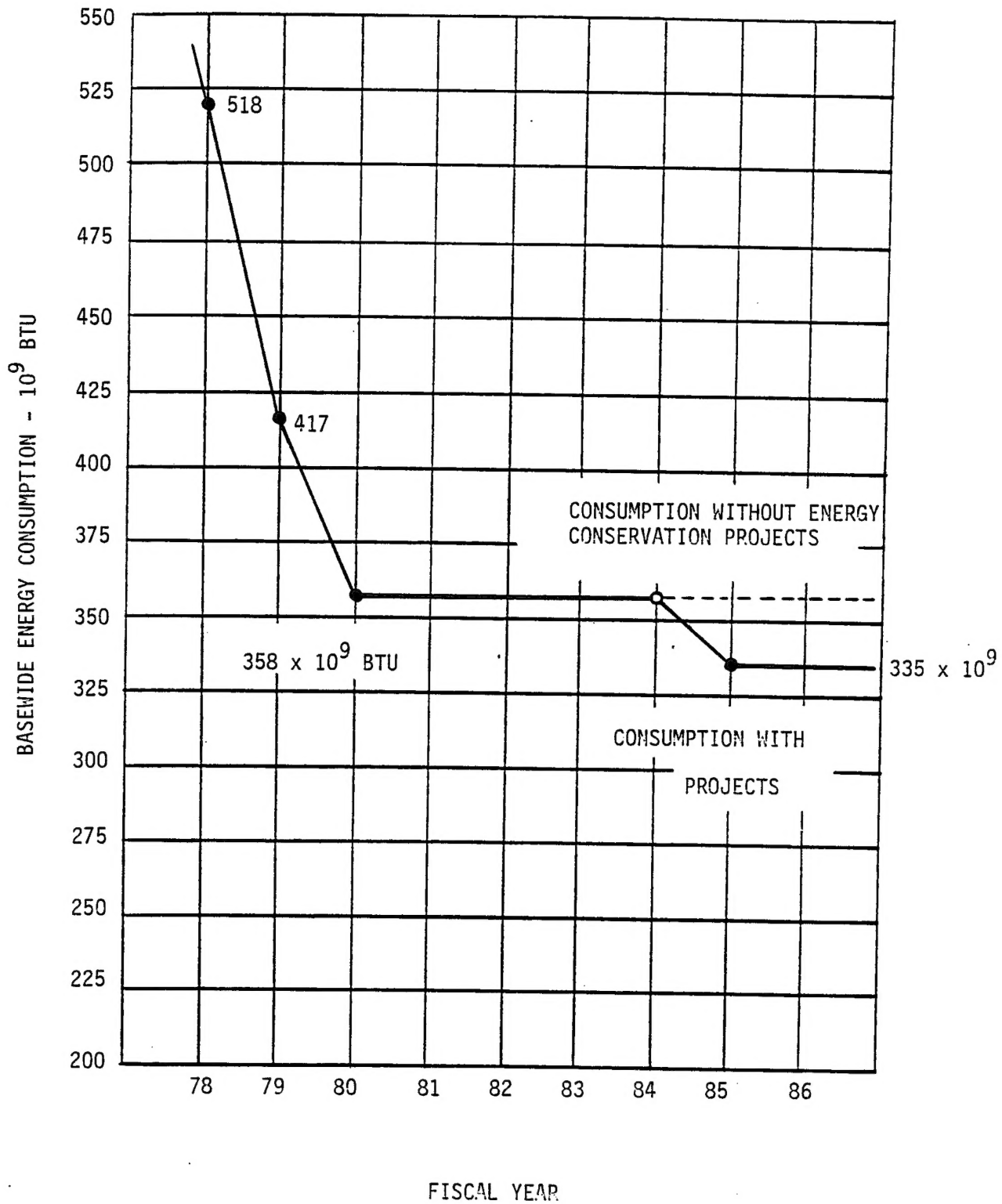
FIGURE 1

BASEWIDE CONSUMPTION FY '80

(358,220 $\times 10^6$ BTU)

PROJECTED ENERGY CONSUMPTION

MILAN AAP



It was determined that the fuel consumption rate for this facility is almost totally weather-dependent. Since less than 1% of the steam generated in the boilers is consumed in process operations, the remainder is therefore consumed in building heating and transmission line losses getting the steam to the buildings. Figure 3 shows the monthly fuel consumption for fiscal year 1980. Note the peak during the cold winter months as compared to the low level of consumption during the summer.

Figure 4 shows the basewide electrical consumption for the past three fiscal years. It can be seen that the January peaks have steadily declined, while the average yearly consumption remains relatively constant around 11 million kilowatt hours. It is apparent the peaks have been reduced as a result of an Executive Order prohibiting supplemental electrical heating units where a building already contains a main source of heat.

The projected basewide energy costs through fiscal year 1986 are shown on Figure 5. Projections are made for the facility if left in its present condition and level of utilization based on FY-80 consumption rate. Predicted costs resulting from the anticipated energy savings upon implementation of all energy conservation projects and recommendations in FY-85 are shown by the solid line graph. The following escalation rates were used for calculation purposes:

Fuel Oil:	1.14 (14%)
Coal:	1.10 (10%)
Electricity:	1.13 (13%)

FUEL CONSUMPTION FY - 80

MILAN AAP

FISCAL YEAR 1980

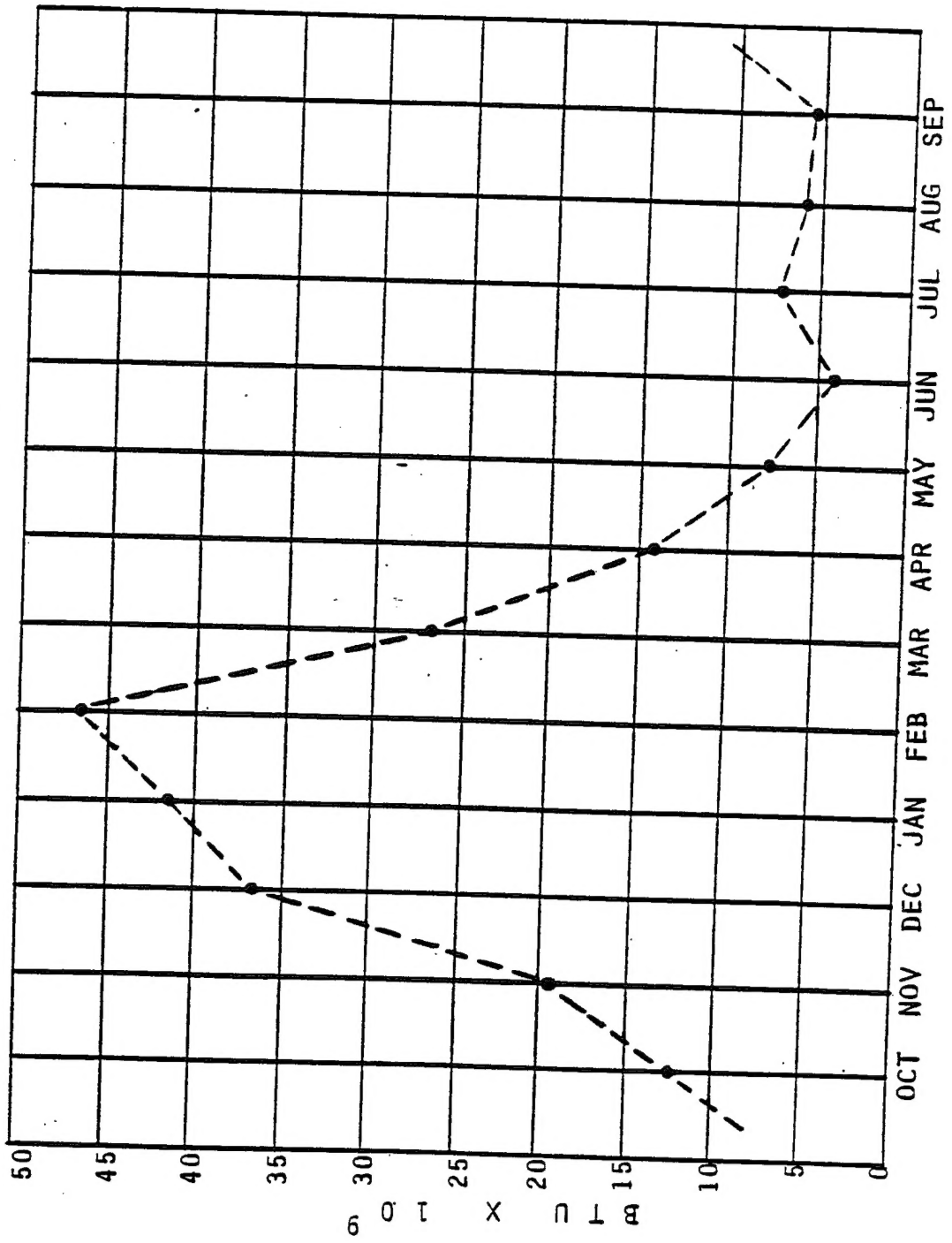


FIGURE 3

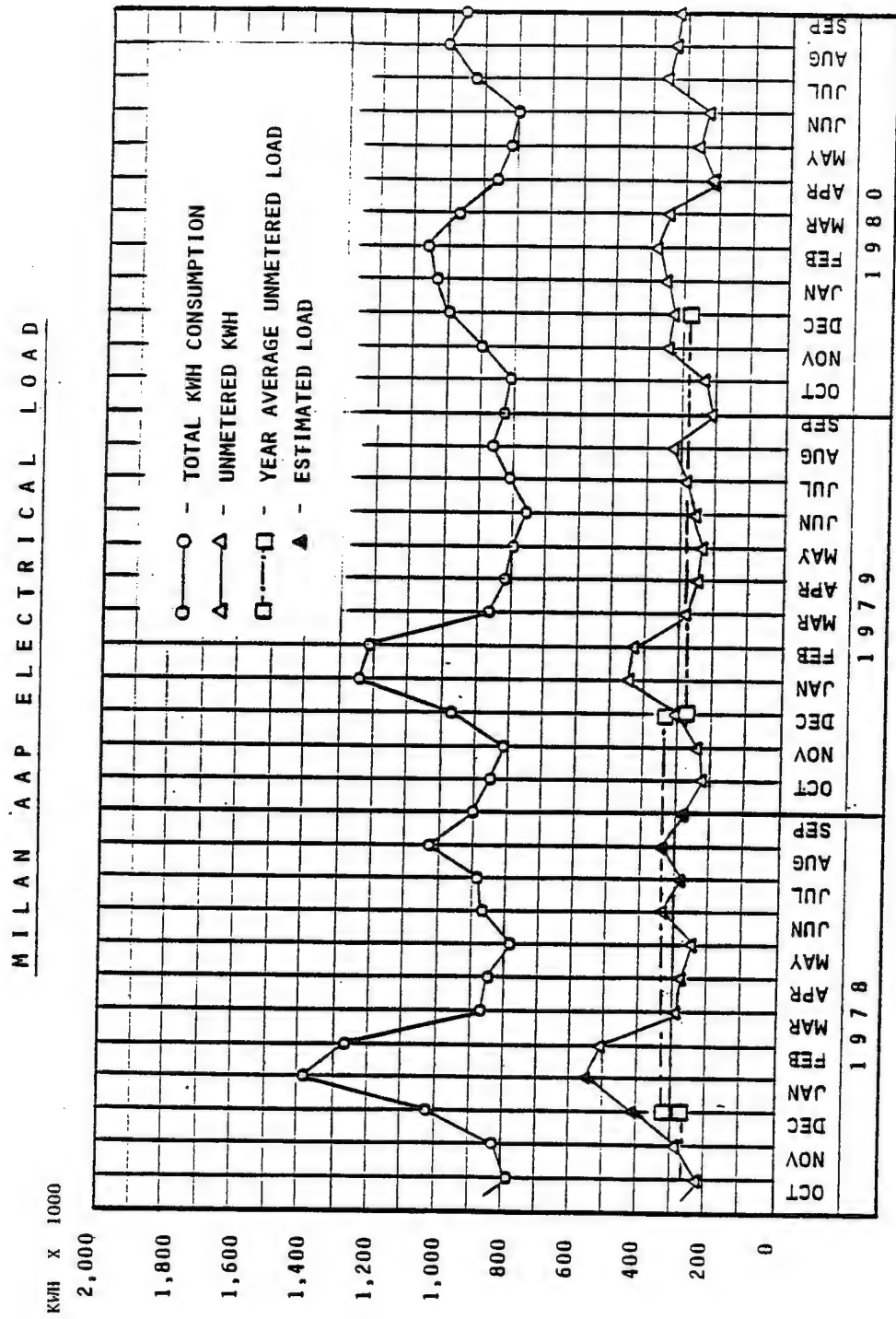


FIGURE 4

PROJECTED ENERGY COSTS

M I L A N A A P

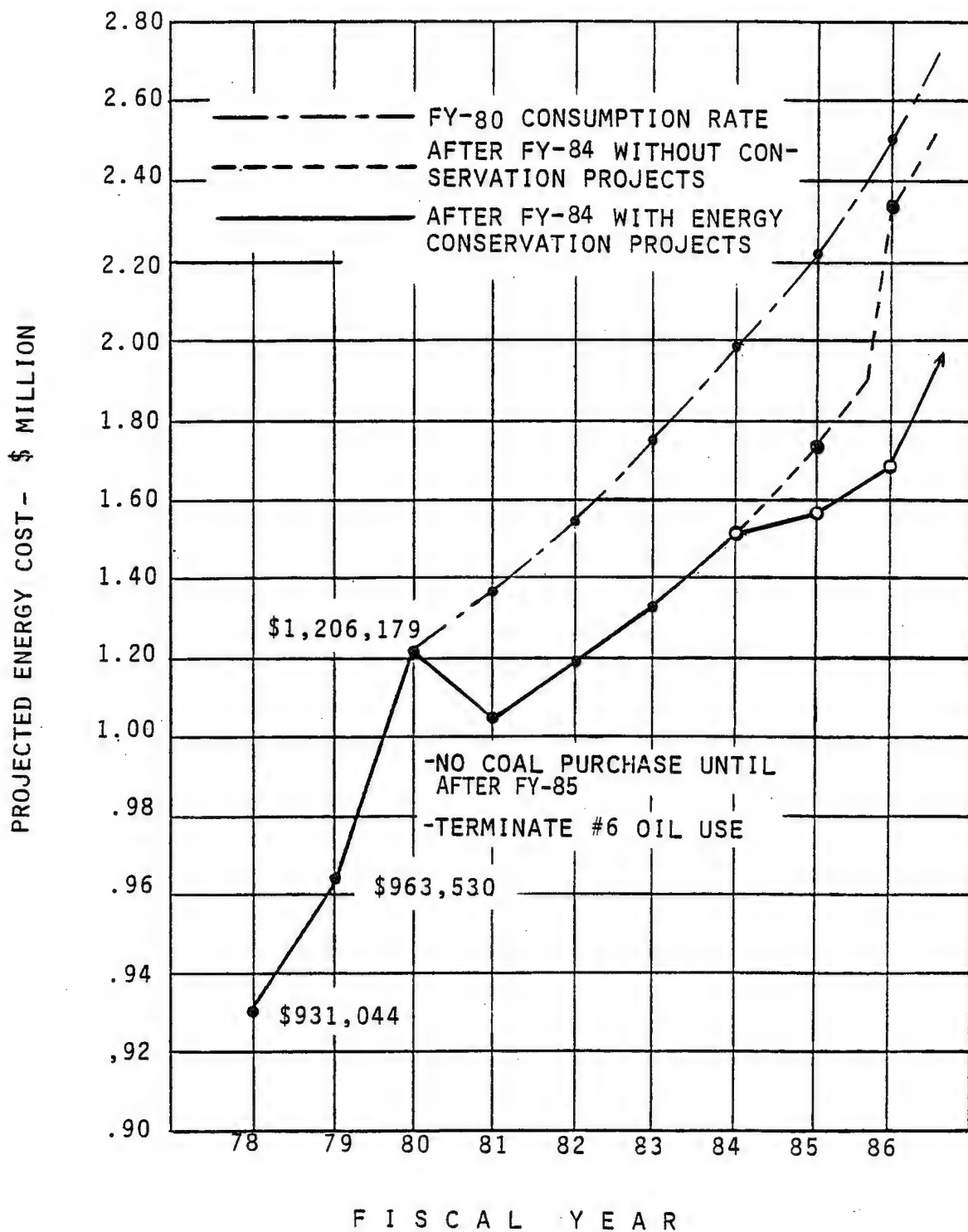


FIGURE 5

A total of 3.2% or 11,500 Mega BTU can be saved annually upon implementation of the viable ECAM projects determined by this study. Figure 6 shows the total source energy reduction. Further breakdown of the total savings yields the following:

Fuel Oil	$7,520 \times 10^6$ BTU saved
Coal	$2,800 \times 10^6$ BTU saved
Electricity	$1,200 \times 10^6$ BTU saved

An additional 10,600 Mega BTU, or 2.9% savings in basewide coal consumption can be achieved by implementation of recommended energy conservation projects which do not qualify for ECAM funding. (See Appendix A of this summary).

ECAM Projects for source energy reduction are listed in Table 1 with their corresponding E/C ratio. Table 2 contains projects not qualifying for ECAM funding, i.e., requiring less than \$100,000 capital expenditure, but which are good energy-saving measures.

Further explanation of the historical energy consumption, basewide energy model, and energy conservation analysis can be found in the Energy Use Survey, Section 3 of this report. The analysis for temperature control schemes and basewide EMCS applications is included in the report on Energy Monitoring and Control Systems, Section 4 of this report.

BASEWIDE CONSUMPTION AFTER FY-85

ENERGY CONSERVATION PROJECTS

CURRENT (FY-80) CONSUMPTION = $358,000 \times 10^6$ BTU

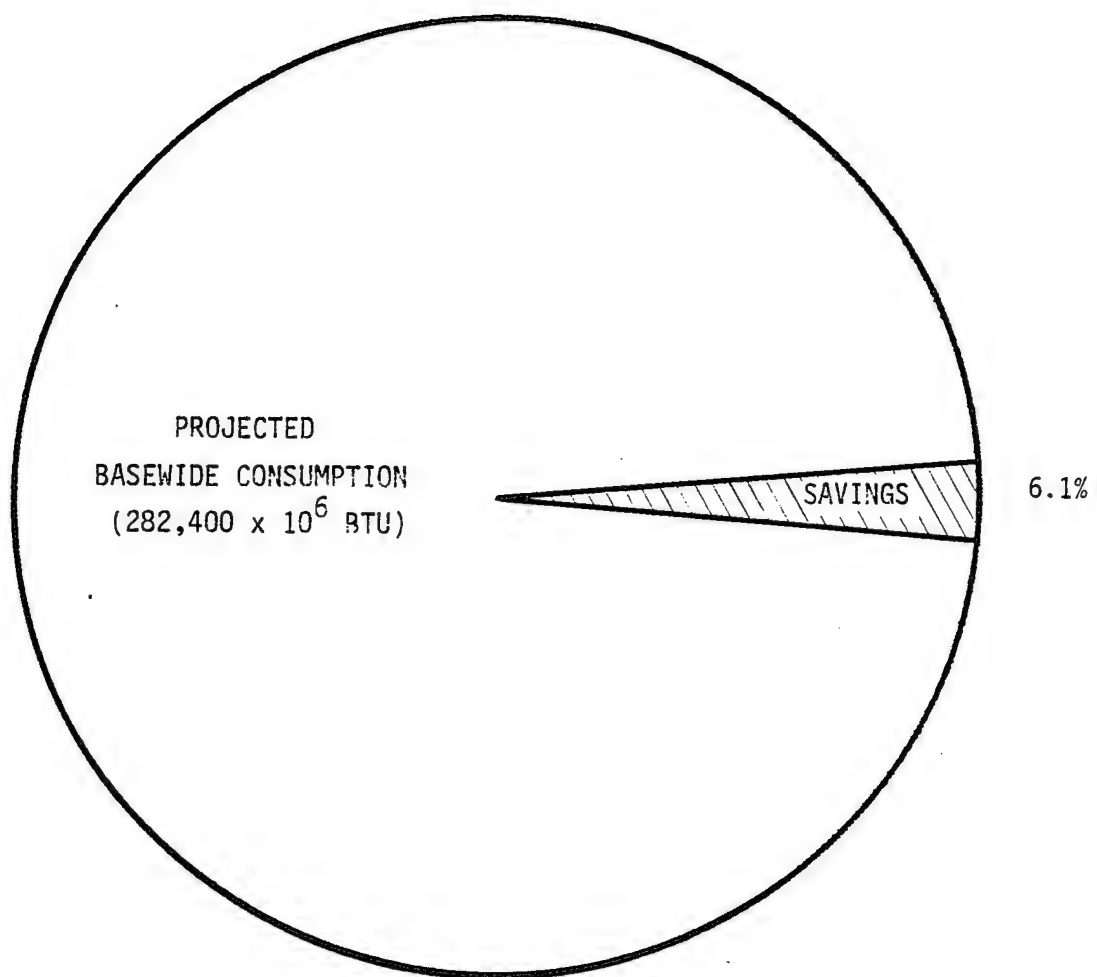


FIGURE 6

ECAM PROJECT SUMMARY

MILAN ARMY AMMUNITION PLANT

PROJECT NO.	PROJECT TITLE	BUILDINGS	CAPITAL \$ COST \$	ELEC.	ENERGY SAVED - OIL	MEGA BTU COAL	TOTAL	B/C	E/C	PB YEARS
M-101	Insulation: B Line	(7)	406,400	(-) 70	3230	-	3300	3.2	8.5	5.7
M-102	Insulation: X-Line	(11)	482,900	2.0	3241	-	3243	2.6	7.0	6.8
M-103	Insulation: D-Line, H-Line, O-Line & J Area	(12)	460,400	8.8	-	3662	3750	0.9	8.6	14.9
M-104	Temp. Controls	(92)	198,500	1211	7526	2796	11533	11.3	60.9	1.0
M-105	Basewide EMCS	(68)	889,200	1286	7289	2796	11371	2.15	13.3	5.8

NOTE: 1. Projects M-101, M-102 and M-103 do not qualify for ECAM funding.

2. Projects M-104 and M-105 are similar. One or the other may be chosen for programming.

TABLE 1

TABLE 2
ENERGY CONSERVATION PROJECTS
UNDER \$100,000

PROJECT TITLE	ANNUAL ENERGY SAVINGS	COST 1984
Replace (10) Expansion Fittings in Steam Distribution System	390 x 10 ⁶ BTU	\$28,200
Replace U/G District Steam Piping - Line "D"	6580 x 10 ⁶ BTU	\$55,000
Replace U/G District Steam Piping - Line "H"	3630 x 10 ⁶ BTU	\$71,400

Total Annual Savings = 10,600 Mega Btu

The composite total in energy reduction for building improvement projects is not a simple algebraic summation of individual project's energy savings. Due to synergistic effects, the average composite total savings are approximately 63% of the simple sum. Consideration must be given to these synergistic effects when arriving at energy savings using different combinations of energy conservation projects.

The addition of simple temperature controls (Project M-104) or the installation of a basewide EMCS (Project M-105) essentially accounts for the same block of energy to be saved. One or the other may be chosen, and thus the energy savings can only be taken credit for one time. Although the initial cost is greater to install the EMCS, it does have a decided advantage over the simpler temperature controls arrangement due to its inherent ability to monitor and report out of state operating conditions. This discourages tampering by personnel and ultimately guarantees energy savings, provided the system is properly installed and maintained. The total basewide energy reduction figure quoted includes the savings resulting from Temperature Controls installation.

A detailed study of the utilization of Biomass material from the 21,800 acre Milan Site as an energy source was conducted. This study indicated that it would take 20 to 25 years to develop woodlands capable of maintaining a reasonably uniform level of Biomass material.

At present, wood biomass would be a more expensive fuel than coal or oil at Milan AAP. Due to the high moisture content of wood and handling expenses, the cost of burning wood grown on site would be about 1.7 times that of coal per useful BTU equivalent.

However, since there is a growing market for pulp wood in this location, it appears desirable to plant loblolly pine in several suitable areas in rotation during the coming years. The harvesting of this pine would begin after 20 to 25 years, and depending upon conditions existing at that time, be utilized in one of three ways. The wood may be burned as fuel at Milan AAP, sold to pulp mills, or burn the low quality wood at Milan and sell the high quality wood to pulp mills. Accordingly, it is desirable that some of the boilers which may be installed in the coming years be capable of conversion to burning wood, with minimum adaption, in the future. Companies in the vicinity of Milan which generate waste wood materials all have existing markets for their materials. A detailed analysis is included in the Biomass Survey, Section 5 of this report.

Based on instructions received at the 40% review meeting on June 17, 1981, this report was directed to cover only the currently operational lines B, D, H, X, I and K-10 and areas K, Q, J and T on their present operating schedules, approximately 15% mobilization.

Field surveys, hand calculations and computer calculations had initially been prepared for the entire base assuming 100% mobilization on a 5-8-3 shift operation, according to the initial scope of work. It was subsequently agreed that the basewide energy use model derived in this manner could be scaled down to current mobilization levels without re-running the DOE 2.1 computer analysis, by developing factors using manual calculation methods. These factors were then applied to the computer generated energy figures to obtain current building energy requirements and ECAM project savings.

It is suggested that the supporting documentation of this report be reviewed if mobilization levels are increased or operating areas changed, to determine if potentially viable projects for energy conservation may exist in these other production lines or areas. Examples include relighting for interconnecting walkways and consolidation of the compressed air systems, which promise economically attractive energy savings during periods of maximum mobilization.

The Basewide Energy Plan Recommendations for the Milan Army Ammunition Plant are presented in Section 6 of this report. Copies of ECAM Projects generated as a result of this energy Engineering Analysis are included in Volume 1 under Section 7.

APPENDIX A

- A-1 IMPLEMENTATION OF EXPANDED MAINTENANCE PROGRAM
- A-2 POTENTIAL CONSERVATION MEASURES REQUIRING
 CAPITAL INVESTMENT
- A-3 POTENTIAL CONSERVATION MEASURES REQUIRING
 POLICY CHANGE

A-1 IMPLEMENTATION OF AN EXPANDED MAINTENANCE PROGRAM

The following energy conservation and/or control projects are discussed in the report as viable projects under an expanded maintenance program.

1. Addition of water preheat coils in laundry waste water sump.
2. Control changes in building H-115 to utilize outside air for makeup under certain temperature conditions.
3. Replacement of malfunctioning or disconnected steam traps.
4. Repair of pipe hangers and supports to align pipe.
5. Repair of damaged pipe insulation.
6. Repair or replacement of leaking valves.
7. Initiate program to locate and repair compressed air, steam, condensate, water and sewer line leaks.
8. Interconnect compressed air systems.
9. Renegotiate electric demand rates.
10. Adjust fuel inventory.
11. Install oil and steam flow meters on operating lines.
12. Install electric meters on all operational substations.
13. Install run-off water control and treatment at coal storage area.
14. Add coal fired boilers to reduce oil consumption.
15. Add uninterruptable power supplies to all microprocessor or computer facilities.
16. Add emergency generators where total power failure could cause a hazardous situation.

A-2 POTENTIAL CONSERVATION MEASURES REQUIRING CAPITAL INVESTMENT

Project Studied	Comments
1. Install vestibules around high traffic doors.	This project has limited application. The calculations are subject to numerous assumptions.
2. Install solar shading devices: . Solar Film . Solar Screens . Overhangs . Awnings	This project has limited application.
3. Install attic ventilation fans.	This project has limited application to the Administration Bldg. and would likely disrupt the performance of window air conditioners.
4. Install whole-house attic fans.	The savings are too occupant-dependent.
5. Reset outside air dampers to minimum requirements of ASHRAE 62-73.	This project has limited application.
6. Install boiler economizers, oxygen trim controls, blowdown heat reclaim devices, etc.	Not cost effective for heating boilers due to short duty cycle.
7. Install storm windows.	This project has limited further applications.
8. Weatherstrip doors.	Good Project.
9. Add floor, ceiling, and wall insulation.	This is a good project where there is no insulation present, however, short heating cycles prevent meeting ECAM criteria.
10. Install setback/setup controls.	Good Project.
11. Add warmup cycle with fresh air dampers closed where setback/setup controls are used.	Good Project.

A-2 POTENTIAL CONSERVATION MEASURES REQUIRING CAPITAL INVESTMENT
(Continued)

Project Studied	Comments
12. Install flue dampers, smaller jets, dual burners, electronic ignition, etc. in small furnaces.	Not cost effective for heating boilers due to short duty cycle.
13. Replace manual control valves or install temperature regulators in cast-iron radiators.	Not cost effective where thermostatic controls are being provided.
14. Replace existing coal boilers with gas/oil conversion kits with modern packaged boilers.	This project does not meet the criteria.
15. Replace incandescent lighting with higher efficiency lighting systems.	Good Project.
16. Install photocell lighting controls.	This project has limited application.
17. Replace existing motors with motors of the high efficiency type.	Limited application due to short duty cycles on current level of mobilization.
18. Reduce lighting levels to minimum standards.	Limited application - most facilities are below minimum standards.
19. Install water closet tank inserts, flow reducing shower heads, or other water conserving devices to reduce pumping energy consumption.	Limited Application.
20. Insulate existing steam lines.	This project does not meet the criteria in most areas due to short duty cycle.
21. Revise existing chilled water/hot water pumping schemes to more efficient methods.	N/A

A-2 POTENTIAL CONSERVATION MEASURES REQUIRING CAPITAL INVESTMENT
(Continued)

Project Studied	Comments
22. Deactivate individual room thermostats in barracks and install temperature reset controls on chilled and hot water.	N/A.
23. Shut down steam plants in the summer and satisfy process steam needs with electric boilers.	N/A.
24. Install infrared heating in warehouses and shops.	This project does not meet the criteria due to short heating duty cycles.
25. Install economizer systems for "free cooling" in intermediate seasons.	This project does not meet the criteria in retrofit applications.
26. Modify multizone systems to include hot/cold deck reset.	N/A.
27. Modify cooling tower systems to cycle fan with load and/or install bypass valving.	N/A.
28. Install load-shedding system to minimize demand charges.	N/A.
29. Correct power factor.	This project does not meet the criteria.
30. Install chilled and hot water reset controls.	N/A.
31. Install FM radio control system.	N/A.
32. Replace existing windows with insulating panels.	Good Project - Limited application.
33. Insulate temporary buildings.	N/A.

A-2 POTENTIAL CONSERVATION MEASURES REQUIRING CAPITAL INVESTMENT
(Continued)

Project Studied	Comments
34. Upgrade electrical distribution voltage.	N/A.
35. Install total or selective energy plants.	N/A.
36. Install energy monitoring and control system.	Good Project.
37. Install heat reclaim devices on air-cooled condensers.	Limited application.
38. Replace remotely located absorption chillers with more efficient electric-driven chillers.	N/A.
39. Install solid waste-burning boilers.	This project does not meet the criteria.
40. Install trailer enclosing devices at loading docks.	This project has limited application.
41. Install solar energy systems where feasible.	This project does not meet the criteria.
42. Install air-to-air heat reclaim devices in high exhaust areas, such as messhall kitchens.	This project does not meet the criteria.

A-3 POTENTIAL CONSERVATION MEASURES REQUIRING POLICY CHANGES
 AT INSTALLATION LEVEL

Project Studied	Comments
1. Replace domestic water heaters with higher efficiency models as replacement is required.	Good Project.
2. Shut down steam boilers and branch lines in summer.	Currently practiced.
3. Reduce domestic hot water temperatures from 140 F to 110-120 F.	Good Project.
4. Replace electric motors with motors of the high efficiency type on replacement basis.	Good Project. Limited application due to motor frame sizes of older equipment.
5. Use task lighting.	Good Project.
6. Install temporary 4-mil plastic storm windows.	Limited application due to short heating cycle.
7. Shut down HVAC and DHW systems in unoccupied buildings.	Good Project.
8. Calk cracks on self-help basis.	Good Project.
9. Install high-efficiency transformers on replacement basis.	Good Project.
10. Enforce indoor space temperature regulations.	Currently practiced.
11. Repair steam and condensate leaks.	Good Project.
12. Repair air leakage in ducts.	N/A.
13. Turn pilot lights for heating equipment off for the summer.	Good project - Limited application.
14. Replace air-conditioning units with high efficiency models as replacement is required.	Good Project.

APPENDIX B

- B-1 TYPICAL BUILDING DATA
- B-2 BUILDING ENERGY SUMMARY
- B-3 ECAM PROJECT SAVINGS

This appendix includes summaries of building data as collected and analyzed by the computer program.

Table 1 - Lists the category code and buildings selected as prototypes for computer calculations

Table 2 - Lists the prototype buildings and their source energy consumption @ 100% mobilization.

Table 3 - Lists infiltration rates used for the computer analysis under different insulation conditions.

TABLE I

Prototype/Computer Simulated			Similar Buildings
Category Code	MAAP Bldg. No.	Function	
A-1-E	T-1	Admin.	T-2, 10; D-44, F-50
A-1-E	T-114	Computer Bldg.	None
A-1-F D-1-F CH-1-F	X-20	Admin., Cafe, Change House	B-20; D-11; H-12; The following buildings are similar to A/C zone of X-20 only: I-23; J-10; O-15
CH-1-F	X-21	Change House, Boiler Plant	B-21; J-2, 3, 5, 8, 52, 106, 111, 123; V-101 thru 104, V-201 thru 204
D-1-E	T-113	Cafeteria	The following Bldgs. are similar to A/C zone of T-113 only: H-111, 115; J-124, 135; V-20, 21
FH-1-E	Q-23	Family Housing	Q-1 thru Q-22, Q-24 thru Q-32
M-1-E	I-3	Vehicle Repair	I-4, 5, 6, 7, 9, 40, 154; J-9; K-301, 312, 315
M-1-F	C-6	Production	J-129, 130; V-22 thru 26
M-1-F	X-4	Pelletizing	I-4
M-1-F	X-8	Assembly (Production)	H-81
M-1-F	X-12	Assembly (Production)	B-12; O-1, 3, 4
M-1-F	X-14	Assembly (Production)	B-14; D-3
M-1-F	X-18	Assembly (Production)	B-18
M-1-F	X-27	Assembly (Production)	None
M-1-F	X-41	Melt-Pour (Production)	O-14 (heated only portion of X-41)
W-1-F	X-2	Storage	None
W-1-F	X-33	Inert Storage	B-10, 15, 16, 19, 261; H-3, 5; X-7, 10, 17, 19

TABLE 2
TYPICAL BUILDING ENERGY CONSUMPTION DATA
MAAP

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTU x 10 ⁶					ELEC. ENERGY CONSUMPTION		BTU x 10 ⁶ / SQ. FT./YR
			FUEL		ELEC.	TOTAL	KW PEAK	KWH/YEAR		
			COAL	OIL						
A-I-E	T-1	Administration	--	2675.4	5752.8	8428.2	264.5	495,931	0.167	
A-I-E	T-114	Computer Bldg.	--	113.8	1459.8	1573.6	38.0	125,845	0.273	
A-I-F CH-I-F D-I-F	X-20	Change House, Cafeteria, Off.	--	2831.3	1099.3	3930.6	72.0	94,767	0.254	
CH-I-F	X-21	Change House, Boiler Plant	--	1522.8	145.0	1667.8	18.5	12,500	0.122	
D-I-E	T-113	Cafeteria	--	657.4	1083.3	1740.7	49.2	93,388	0.143	
FH-I-E	Q-23	Family Housing	--	149.3	132.6	281.9	3.2	11,431	0.118	
M-I-E	I-3	Vehicle Repair	--	2429.5	1108.5	3538.0	37.5	95,560	0.117	
M-I-F	CC-6	Production	--	502.1	267.1	769.2	9.0	23,026	0.078	
M-I-F	X-4	Pelletizing	--	875.2	323.9	1199.1	11.6	27,922	0.248	
M-I-F	X-8	Assembly (Production)	--	1182.0	419.1	1601.1	15.0	36,129	0.244	
M-I-F	X-12	Assembly (Production)	--	1683.9	477.3	2161.2	17.1	41,147	0.281	
M-I-F	X-14	Assembly (Production)	--	2699.8	1210.0	3909.8	40.9	104,310	0.195	
M-I-F	X-18	Assembly (Production)	--	3355.9	855.0	4210.9	30.6	73,707	0.248	

Table 2 Continued

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTU x 10 ⁶					ELEC. ENERGY CONSUMPTION		BTU x 10 ⁶ / SQ. FT. / YR.
			FUEL		ELEC.	TOTAL	KW PEAK	KWH/YEAR		
			COAL	OIL						
M-I-F	X-27	Assembly (Production)	--	1154.4	360.5	1514.9	12.9	31,078	0.215	
M-I-F	X-41	Melt-Pour (Production)	--	3154.3	1380.6	4534.9	91.6	119,017	0.261	
W-I-F	X-2	Storage	--	492.5	118.6	611.1	4.0	10,224	0.255	
W-I-F	X-33	Inert Storage	--	2435.8	282.9	2718.7	9.6	24,388	0.245	

MILAN AAP

AIR CHANGE RATES USED FOR INFILTRATION

<u>BLDG. NO</u>	<u>AS IS</u>	<u>INSUL. ROOF</u>	<u>INSUL. WALLS</u>	<u>REDUCE GLASS</u>
X-2	5	4.5	4	4.5
X-4	7	6.5	5	6.5
X-8	5	4.5	4	4.5
X-12	5	4.5	4	4.5
X-14	5	4.5	4	4.5
X-18	5	4.5	4	4.5
X-20	4	3.5	3	3.5
X-21	4	3.5	3	3.5
X-27	5	4.5	4	4.5
X-33	4	3.5	3	3.5
X-41	4	-	-	-

TABLE 3

This appendix lists the energy requirements for all heated/cooled buildings at MAAP, for 100% mobilization and 15% mobilization levels.

The energy requirements reported in the 100% table represent energy requirements that would result if operations were scheduled around the clock with all lines operating.

The 15% tables reflect the application of scaling factors derived considering single shift operation of production lines and the current practice of Milan operating personnel of shutting down boilers when the ambient air temperature is expected to remain reasonably above freezing during non-working hours.

PROTOTYPE		BLDG.		MAAP		DATA	
		100		ENERGY		CONSUMP.	
		PER		CENT		MOBIL.	
		AS IS					
		BLDG.		ANNUAL		ENERGY	
		CONSUMP.		MBTU		CONSUMP.	
		BLDG.		BLDG.		ELEC.	
		ELEC.		ELEC.		ELEC.	
		A/C		A/C		A/C	
		ELEC.		ELEC.		ELEC.	
		KW		KW		KW	
		PEAK		PEAK		PEAK	
		TOTAL		TOTAL		TOTAL	
		OIL+ELEC.		OIL+ELEC.		OIL+ELEC.	
		LTG.		LTG.		LTG.	
		ELEC.		ELEC.		ELEC.	
		FUEL		FUEL		FUEL	
		OIL		OIL		OIL	
		BLDG.		BLDG.		BLDG.	
		SQ.		SQ.		SQ.	
		FT.		FT.		FT.	
		BLDG.		BLDG.		BLDG.	
		DESCRIP.		DESCRIP.		DESCRIP.	
		NO.		NO.		NO.	
		GROUP		GROUP		GROUP	
		NO.		NO.		NO.	
		TOTAL		TOTAL		TOTAL	
		SQ. FT./YR		SQ. FT./YR		SQ. FT./YR	
		KWH/YR		KWH/YR		KWH/YR	
		KWH/YR		KWH/YR		KWH/YR	
		KWH/YR		KWH/YR		KWH/YR	
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		KWH/YR		KWH/YR		KWH/YR	
		KWH/YR		KWH/YR		KWH/YR	
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		KWH/YR		KWH/YR		KWH/YR	
		KWH/YR		KWH/YR		KWH/YR	
		KWH/YR		KWH/YR		KWH/YR	

ALL BLDG. ENERGY CONSUMP. DATA
AS 19 100 PER CENT MOBIL, AAP LINES

PROTOTYPE BLDG.	BLDG. NO.	BLDG. SQ. FT.	FUEL		ANNUAL ELEC.	LTG. ELEC.	A/C+LTG. ELEC.	TOTAL ELEC.	MBTU	BLDG.	ELEC.		TOTAL SQ.FT./YR	TOTAL MBTU/ YR
			OIL								CONSUMP.			
X-14	A-2	15083	1863.30		0.00	2167.29	2167.29	4030.59					186835	26722708
X-18	A-3	19260	3520.39		0.00	1729.68	1729.68	5250.07					149110	27258910
X-18	A-4	15881	2902.77		0.00	1426.22	1426.22	4328.99					122950	27258926
X-33	A-5	640	128.64		0.00	38.77	38.77	167.41					3342	26157375
X-33	A-6	640	128.64		0.00	38.77	38.77	167.41					3342	26157375
X-33	A-7	640	128.64		0.00	38.77	38.77	167.41					3342	26157375
X-33	A-8	640	128.64		0.00	38.77	38.77	167.41					3342	26157375
X-33	A-9	640	128.64		0.00	38.77	38.77	167.41					3342	26157375
X-20	A-14	15500	2597.50		714.88	1075.67	1790.55	4388.05					3342	26157375
X-21	A-15	12820	1307.36		0.00	323.05	323.05	1430.41		61628			92730	28310018
X-33	A-33	11118	2234.70		0.00	673.48	673.48	2908.18					2749	12717694
X-33	A-34	11118	2234.70		0.00	673.48	673.48	2908.18					58059	26157442
X-33	A-39	2571	516.77		0.00	155.74	155.74	672.51					58059	26157442
X-33	A-40	1044	209.84		0.00	63.24	63.24	273.08					13426	6157588
X-33	A-43	200	40.20		0.00	12.11	12.11	52.31					5452	6157395
X-33	A-44	400	80.40		0.00	24.23	24.23	104.63					1044	261552
X-2	B-2	2436	458.58		0.00	286.55	286.55	745.13					2089	261581
X-4	B-4	2798	469.46		0.00	335.04	335.04	804.50					24703	30588456
X-12	B-12	3296	667.77		0.00	365.08	365.08	1032.85					28883	28752781
X-14	B-14	23050	2847.51		0.00	3312.07	3312.07	6159.58					31472	31336323
X-33	B-15	54	10.85		0.00	3.27	3.27	14.12					285523	26722676
X-33	B-16	640	128.64		0.00	38.77	38.77	167.41					282	26150370
X-18	B-18	15996	2923.79		0.00	1436.54	1436.54	4360.33					3342	26157375
X-20	B-20	15500	2597.50		714.88	1075.67	1790.55	4388.05					123840	27258902
X-21	B-21	14050	1432.79		0.00	354.04	354.04	1786.83		61628			154358	28310018
X-33	B-33	11118	2234.70		0.00	673.48	673.48	2908.18					30521	12717677
X-33	B-34	11118	2234.70		0.00	673.48	673.48	2908.18					58059	26157442
X-262	B-262	296	59.50		0.00	17.93	17.93	77.43					58059	26157442
X-33	B-263	296	59.50		0.00	17.93	17.93	77.43					1546	2616
TOTALS	29	208843	34276.42		1429.77	17107.90	18537.67	52814.09		123256	1474819		1598075	25288896

PROTOTYPE BLDG.	BLDG. NO.	BLDG. SQ. FT.	ALL		BLDG.		MAAP ENERGY		CONSUMP.		DATA	
			AS IS	100	PER	CENT	MOBIL.	C	LINE			
										BLDG.	ANNUAL	ENERGY
			FUEL OIL	A/G ELEC.	LIG, ELEC.	A/C+LIG. ELEC.	TOTAL OIL+ELEC.					
C-6	C-1	2420	113.58	0.00	156.82	156.82	270.40					
C-6	C-3	17241	809.17	0.00	1117.28	1117.28	1926.45					
C-6	C-5	3380	158.63	0.00	219.04	219.04	377.67					
C-6	C-6	9814	460.60	0.00	635.98	635.98	1096.58					
X-33	C-9	640	128.64	0.00	18.77	38.77	167.41					
X-18	C-10	12050	2202.33	0.00	1082.17	1082.17	3284.70					
X-20	C-11	21458	3595.95	989.68	1489.14	2478.82	6074.76					
C-6	C-12	10687	501.57	0.00	692.56	692.56	1194.13					
X-33	C-14	336	67.54	0.00	20.35	20.35	87.89					
C-6	C-19	1280	60.07	0.00	82.95	82.95	143.02					
X-33	C-21	244	49.04	0.00	14.78	14.78	63.82					
X-33	C-22	244	49.04	0.00	14.78	14.78	63.82					
X-33	C-23	244	49.04	0.00	14.78	14.78	63.82					
C-6	C-24	7140	335.10	0.00	462.70	462.70	797.80					
X-33	C-33	11118	2234.70	0.00	673.48	673.48	2908.18					
X-33	C-34	11118	2234.70	0.00	673.48	673.48	2908.18					
C-6	C-41	11708	549.49	0.00	758.72	758.72	1308.21					
X-41	C-42	10508	1746.91	116.54	1867.24	1984.18	3731.09					
C-6	C-45	896	42.05	0.00	58.06	58.06	100.12					
X-33	C-46	576	115.78	0.00	34.89	34.89	150.67					
X-33	C-62	640	128.64	0.00	38.77	38.77	167.41					
X-33	C-72	640	128.64	0.00	38.77	38.77	167.41					
X-33	C-100	642	129.04	0.00	38.89	38.89	167.93					
TOTALS	23	135024	15890.45	1106.62	10224.39	11331.01	27221.46					

ALL		BLDG.		ENERGY		MAAP		CONSUMP.		DATA	
AS IS		100 PER CENT		MOBIL.		F LINE &		F AREA			
BLDG.		ANNUAL		ENERGY		CONSUMP.		MBTU			
PROTOTYPE BLDG.	BLDG. NO.	BLDG. SQ. FT.	FUEL OIL	A/C ELEC.	LIG. ELEC.	A/C+LIG. ELEC.	TOTAL OIL+ELEC.	A/C KWH/YR	ELEC. KWH/YR	ENERGY TOTAL KWH/YR	TOTAL MBTU/ SQ. FT. /
X-33	F-1	54	10.23	0.00	3.09	3.09	13.34	0	266	266	24695556
X-33	F-2	225	45.23	0.00	13.63	13.63	58.86	0	1175	1175	2616
X-33	F-3	1369	275.17	0.00	82.93	82.93	358.10	0	7149	7149	26157663
X-8	F-4	4080	820.08	0.00	247.15	247.15	1067.23	0	21306	306	26157588
X-33	F-5	54	10.23	0.00	3.09	3.09	13.34	0	266	266	24695556
X-33	F-6	225	45.23	0.00	13.63	13.63	58.86	0	1175	1175	2616
X-33	F-7	1283	257.88	0.00	77.72	77.72	335.60	0	6700	12742	26157443
X-8	F-8	2440	490.44	0.00	147.81	147.81	638.25	0	1775	1775	26155803
X-33	F-9	340	68.34	0.00	20.59	20.59	88.93	0	170711	170711	27280715
X-18	F-11	22050	4035.15	0.00	1980.25	1980.25	6015.40	0	6319	6319	26157884
X-33	F-12	1210	243.21	0.00	73.30	73.30	316.51	0	627	627	26161
X-33	F-17	120	24.12	0.00	7.27	7.27	31.39	0	376	376	26157778
X-33	F-18	720	144.72	0.00	43.62	43.62	188.34	0	72394	12050	28352450
X-20	F-19	12100	2032.80	558.08	839.77	1397.85	3430.65	48110	15486	56992	25424364
X-21	F-20	7130	727.26	0.00	179.64	179.64	906.90	0	46376	627	26161
T-1 AREA	F-50	3190	149.93	123.15	537.96	661.11	811.04	10616	627	627	26161
X-33	F-171	120	24.12	0.00	7.27	7.27	31.39	0	627	627	26161
TOTALS		56710	9404.18	681.22	4278.71	4959.93	14364.11	58726	368854	427560	25329057

PROTOTYPE BLDG.	BLDG. NO.	ALL BLDG.		MAAP ENERGY CONSUMP.		DATA		BLDG.
		AB 18		100 PER CENT		MOBIL. H&I LINES		
		ANNUAL ELEC.	LTG. ELEC.	A/C+LTG. ELEC.	TOTAL OIL+ELEC.	MBTU	KWH/YR	
FUEL OIL	A/C ELEC.	120	24.12	0.00	7.27	7.27	31.39	0
X-33	H-6	13800	2318.40	636.48	957.75	1594.23	3912.63	54869
X-20	H-12	4110	826.11	0.00	248.96	248.96	1075.07	0
X-33	H-81	120	24.12	0.00	7.27	7.27	31.39	0
X-33	H-91	120	24.12	0.00	7.27	7.27	31.39	0
X-33	H-92	54	10.25	0.00	3.09	3.09	13.34	0
T-113	H-102	3760	139.12	161.55	320.93	482.48	621.60	13927
T-113	H-111	9796	342.45	307.26	636.12	1143.38	1505.83	26488
X-33	I-1	344	69.14	0.00	20.83	20.83	89.97	0
X-33	I-2	180	36.18	0.00	10.90	10.90	47.08	0
X-33	I-3	225	45.23	0.00	13.63	13.63	58.86	0
X-4	I-4	6304	1059.00	0.00	754.88	754.88	1F 3.88	0
X-33	I-51	120	24.12	0.00	7.27	7.27	31.39	0
X-33	I-52	120	24.12	0.00	7.27	7.27	31.39	0
X-33	I-53	120	24.12	0.00	7.27	7.27	31.39	0
I-3	AREA I-3	20040	2228.90	0.00	2640.59	2640.59	4869.49	0
I-3	AREA I-4	12150	1348.65	0.00	1600.94	1600.94	2949.59	0
I-3	AREA I-5	7036	781.00	0.00	927.10	927.10	1708.10	0
I-3	AREA I-6	4237	470.31	0.00	558.28	558.28	1028.59	0
I-3	AREA I-7	1463	162.39	0.00	192.77	192.77	355.16	0
I-3	AREA I-8	1567	173.94	0.00	206.48	206.48	380.42	0
X-20	AREA I-23	5280	258.72	243.52	283.46	526.98	785.70	20993
I-3	AREA I-40	9617	1067.49	0.00	1267.18	1267.18	2334.67	0
I-3	AREA I-154	1296	143.86	0.00	170.76	170.76	314.62	0
TOTALS	24	101979	11643.86	1348.81	11058.29	12407.10	24052.96	116277

MAAP ENERGY CONSUMP. DATA
 BLDG. 100 PER CENT MOBIL. J&K AREAS O L I E

PROTOTYPE BLDG.	BLDG. NO.	BLDG. SQ. FT.	FUEL OIL	A/C ELEC.	LIG. ELEC.	A/C+LIG. ELEC.	TOTAL OIL+ELEC.	MBTU	BLDG. A/C KWH/YR	ELEC. CONSUMP. KWH/YR	ENERGY TOTAL SQ. FT./YR
X-21	J-2	10233	1043.77	0.00	257.82	257.82	1301.59		0	22226	12719550
X-21	J-3	2942	300.08	0.00	74.12	74.12	374.20		0	6390	12719375
X-21	J-4	6360	648.72	0.00	160.24	160.24	808.96		0	13814	12719535
X-21	J-5	16410	1671.82	0.00	413.46	413.46	2087.28		0	35643	12719554
X-21	J-6	1500	153.00	0.00	37.79	37.79	190.79		0	3258	1271952
I-3	J-9	10000	1110.00	0.00	1317.64	1317.64	2427.64		0	113590	2427644
X-20	J-10	6667	1117.26	307.49	462.88	770.17	1887.43		26508	39886	28310018
X-21	J-106	1928	196.66	0.00	48.58	48.58	245.24		0	4188	12719959
X-21	J-123	4100	418.20	0.00	103.30	103.30	521.50		0	8905	12719463
T-113	J-124	3002	111.87	94.16	256.23	350.39	461.46		8117	22089	15371739
C-6	J-129	6779	318.61	0.00	439.34	439.34	757.53		0	37874	11180829
C-6	J-130	28482	1336.12	0.00	1842.39	1842.39	3178.51		0	158827	11159726
T-113	J-135	2000	74.00	62.73	170.71	233.44	307.44		5408	14716	1537192
I-3	K-30	7495	831.95	0.00	987.58	987.58	1819.53		0	85136	24276552
I-3	K-312	10880	1207.68	0.00	1433.60	1433.60	2641.28		0	123586	24276449
I-3	K-315	5840	648.24	0.00	769.51	769.51	1417.75		0	66337	24276527
X-20	K-345	1200	201.60	55.34	83.29	138.63	340.23		4771	7180	28352633
X-12	O-1	3436	697.51	0.00	380.60	380.60	1078.11		0	32810	31376775
X-12	O-3	2912	591.14	0.00	322.56	322.56	913.70		0	27807	31377102
X-12	O-4	5427	1101.68	0.00	601.14	601.14	1702.82		0	51822	31376731
X-20	O-15	4155	696.30	191.64	288.35	479.98	1176.28		16520	24858	28310018
TOTALS	21	141748	1477.41	711.36	10458.92	11162.28	25639.69		61324	900941	962266
											18088220

ALL BLDG: MAAP ENERGY CONSUMP. DATA
AS IS 100 PER CENT MOBIL. '67 LINES

PROTOTYPE BLDG.	BLDG. NO.	BLDG. SQ. FT.	FUEL OIL	ANNUAL ELEC.	A/C ELEC.	LTG. ELEC.	A/C+LTG. ELEC.	TOTAL OIL+ELEC.	MBTU	BLDG. KWH/YR	ELEC. CONSUMP. KWH/YR	ENERGY TOTAL SQ. FT./YR
T-113	V-20	3850	142.45	120.76	0.00	328.68	449.36	591.81		10410	28328	38738 .15371709
T-113	V-21	7750	286.75	243.89	661.49	904.58	1191.33	1191.33		20956	57025	77981 .15371995
C-6	V-22	3050	143.35	0.00	197.66	197.66	341.01	341.01		0	17040	17040 .11180787
C-6	V-23	3050	143.35	0.00	197.66	197.66	341.01	341.01		0	17040	17040 .11180787
C-6	V-24	3050	143.35	0.00	197.66	197.66	341.01	341.01		0	17040	17040 .11180787
C-6	V-25	3050	143.35	0.00	197.66	197.66	341.01	341.01		0	17040	17040 .11180787
C-6	V-26	3050	143.35	0.00	197.66	197.66	341.01	341.01		0	17040	17040 .11180787
X-21	V-101	1456	148.51	0.00	36.68	36.68	36.68	185.19		0	3162	3162 .12719038
X-21	V-102	1456	148.51	0.00	36.68	36.68	36.68	185.19		0	3162	3162 .12719038
X-21	V-103	1456	148.51	0.00	36.68	36.68	36.68	185.19		0	3162	3162 .12719038
X-21	V-104	1456	148.51	0.00	36.68	36.68	36.68	185.19		0	3162	3162 .12719038
X-21	V-201	1456	148.51	0.00	36.68	36.68	36.68	185.19		0	3162	3162 .12719038
X-21	V-202	1456	148.51	0.00	36.68	36.68	36.68	185.19		0	3162	3162 .12719038
X-21	V-203	1456	148.51	0.00	36.68	36.68	36.68	185.19		0	3162	3162 .12719038
X-21	V-204	1456	148.51	0.00	36.68	36.68	36.68	185.19		0	3162	3162 .12719038
X-33	Z-2	989	198.79	0.00	59.91	59.91	59.91	258.70		0	5165	5165 .26158140
X-4	Z-4	3297	353.90	0.00	394.81	394.81	948.71	948.71		0	34035	34035 .28774826
X-33	Z-6	1210	243.21	0.00	73.30	73.30	73.30	316.51		0	6319	6319 .26157884
T-113	Z-8	17050	903.65	534.79	2078.87	2613.67	3517.32	3517.32		46103	179213	225316 .20629417
X-20	Z-10	10450	1755.60	481.97	725.26	1207.22	2962.82	2962.82		41549	62522	104071 .28352379
X-21	Z-11	9920	1011.84	0.00	249.93	249.93	249.93	1261.77		0	21546	21546 .12719492
TOTALS	21	81414	7001.02	1380.61	5853.93	7234.54	14235.56	14235.56		119018	504649	623667 .17485392

ALL BLDG. ENERGY CONSUMP. DATA
AS IS 100 PER CENT MOBIL. X LINE

PROTOTYPE BLDG.	BLDG. NO.	BLDG. SQ. FT.	FUEL OIL	ANNUAL F.E.C.	L.T.G. ELEC.	A/C+L.T.G. ELEC.	QIL+TELEC.	TOTAL	BLDG. A/C KWH/YR	ELEC. CONSUMP. KWH/YR	ENERGY TOTAL SQ.FT./YR
X-2	X-2	2400	451.80	0.00	282.32	282.32	734.12	734.12	0	24338	24338
X-4	X-4	4830	810.40	0.00	578.35	578.35	1388.75	1388.75	0	49858	49858
X-33	X-7	494	99.29	0.00	29.93	29.93	129.22	129.22	0	2580	2580
X-8	X-8	6530	1094.50	0.00	748.36	748.36	1842.86	1842.86	0	64514	64514
X-33	X-11	120	24.12	0.00	7.27	7.27	31.39	31.39	0	627	627
X-12	X-12	7696	1559.20	0.00	852.44	852.44	2411.64	2411.64	0	73486	73486
X-14	X-14	20050	2476.90	0.00	2881.00	2881.00	5357.90	5357.90	0	248362	248362
X-33	X-16	640	128.44	0.00	38.77	38.77	167.41	167.41	0	3342	3342
X-33	X-17	120	24.12	0.00	7.27	7.27	31.39	31.39	0	627	627
X-18	X-18	15000	3107.30	0.00	1526.71	1526.71	4634.01	4634.01	0	131613	131613
X-33	X-19	640	128.44	0.00	38.77	38.77	167.41	167.41	0	3342	3342
X-20	X-20	15500	2597.50	714.88	1075.67	1790.55	4388.05	4388.05	61628	92730	154358
X-21	X-21	13700	1397.10	0.00	345.23	345.23	1742.33	1742.33	0	29761	29761
X-27	X-27	7050	1059.00	0.00	643.70	643.70	1712.70	1712.70	0	55491	55491
X-33	X-28	120	24.12	0.00	7.27	7.27	31.39	31.39	0	627	627
X-33	X-33	11118	2234.70	0.00	673.48	673.48	2988.18	2988.18	0	58059	58059
X-33	X-34	11118	2234.70	0.00	673.48	673.48	2988.18	2988.18	0	58059	58059
X-41	X-41	17408	2894.00	193.73	3093.35	3287.08	6181.08	6181.08	16701	266668	283369
X-33	X-61	651	130.85	0.00	39.44	39.44	170.29	170.29	0	3400	3400
X-33	X-71	651	130.85	0.00	39.44	39.44	170.29	170.29	0	3400	3400
TOTAL	20	135856	22617.73	908.62	13582.23	14490.87	37188.60	37188.60	78329	1170884	1249213
											2731457

PROTOTYPE		BLDG.		MAAP		DATA					
AS IS		15 PER CENT		MOBIL.							
GROUP NO.	BLDG. NO.	BLDG. DESCRIP.	BLDG. SQ. FT.	BLDG.		ENERGY		CONSUMP.		TOTAL	
				FUEL OIL	A/C ELEC.	ANNUAL	ENERGY MBTU	CONSUMP.	MOBIL.	LTG. ELEC.	OIL+ELEC.
A-I-E	T-1	ADMIN	50481	1398.42	1520.83	4256.49	7174.94	131037	366939	901874	.14213149
A-I-E	T-114	COMPUTER OFFICE	5760	113.80	273.90	1185.98	1573.68	23612	102240	125852	.27320889
A-I-F	X-20	CHG HOUSE	15500	1532.53	650.54	451.79	2634.85	56081	38947	154358	.16999031
D-I-F	X-21	CHG HOUSE	13764	824.29	0.00	145.00	969.29	0	12500	29761	.07075102
D-I-E	T-113	CAFE	12184	380.37	347.79	742.78	1470.95	29982*	64033	161015	.2072776
FH-I-E	Q-23	FAMILY HOUSING	2400	49.30	0.00	88.04	137.35	0	7590	10120	.0572275
M-I-E	I-3	VEHICLE REPAIR	20040	1315.05	0.00	1109.05	2424.10	0	95608	227627	.12096326
M-I-F	C-6	PRODUC.	9814	271.75	0.00	267.11	538.87	0	23027	54826	.05490801
M-I-F	X-4	PELLETIZ.	4830	478.14	0.00	323.87	802.01	0	27920	49858	.16604720
M-I-F	X-8	ASSEMBLY	6550	645.76	0.00	419.08	1064.84	0	36128	64514	.16257096
M-I-F	X-12	ASSEMBLY	7696	919.93	0.00	477.36	1397.29	0	41152	7347	.10156071
M-I-F	X-14	ASSEMBLY	20050	1461.37	0.00	1210.02	2671.39	0	104312	248362	.1353364
M-I-F	X-18	ASSEMBLY	17000	1833.31	0.00	854.95	2688.26	0	73703	131613	.1581330
M-I-F	X-27	ASSEMBLY	7050	630.71	0.00	360.47	991.18	0	31075	55491	.14059291
M-I-F	X-41	MELT POUR	17408	1787.46	87.17	1299.21	3093.85	7515	112001	266568	.1772551
M-I-F	X-2	STORAGE	2400	266.56	0.00	118.58	385.14	0	10222	24338	.16047383
M-I-F	X-33	INERT STORAGE	11110	1318.47	0.00	282.87	1601.34	0	24385	58059	.14403121

PROTOTYPE BLDG.	BLDG. NO.	BLDG. SQ. FT.	ALT				MAAP				DATA						
			BLDG.		ENERGY		CONSUMP.		15		D LINE		D AREA				
			AS IS	PER CENT	MOBIL.	BLDG.	ANNUAL	ENERGY	CONSUMP.	MBTU	BLDG.	ELEC.	CONSUMP.	ENERGY	TOTAL	SQ.FT./YR	
						FUEL	A/C	LTG.	A/C+LTG.	TOTAL	A/C	LTG.				TOTAL	MBTU/ SQ.FT./YR
						OIL	ELEC.	ELEC.	ELEC.	OIL+ELEC.	KWH/YR	KWH/YR				KWH/YR	
X-2	D-2	648	71.08	0.00	31.62	31.62	102.70	0	2726	2726	2726	2726	16047300				
X-14	D-3	16763	1221.79	0.00	1011.65	1011.65	2233.44	0	87211	87211	87211	87211	13323637				
X-20	D-11	18900	1868.70	793.24	550.89	1344.13	3212.82	48383	47490	115873	115873	115873	16999063				
T-1 AREA	D-44	4656	128.98	140.20	392.59	532.78	661.76	12086	33844	45930	45930	45930	14213153				
TOTALS	4	40959	3290.55	933.44	1986.74	2920.18	6210.73	80469	171271	251739	251739	251739	15163388				

PROTOTYPE BLDG.	BLDG. No.	BLDG. SQ. FT.	ALL		MAAP		CONSUMP.		DATA		TOTAL SQ.FT./YR	ENERGY KWH/YR	ELEC. CONSUMP. KWH/YR	TOTAL MBTU/ YR	
			AS IS	BLDG.	PER CENT	BLDG.	MORIL.	F LINE &	F AREA						
			BLDG.	ANNUAL	ENERGY	CONSUMP.	MBTU	BLDG.	ELEC. CONSUMP.	A/C KWH/YR	TOTAL OIL-TELEC.				
			FUEL OIL	A/C ELEC.	LTG. ELEC.	A/C+LTG. ELEC.	TOTAL								
X-33	F-1	54	6.40	0.00	1.37	1.37	7.78	0	118			118	118		14403094
X-33	F-2	225	26.68	0.00	5.72	5.72	32.41	0	493			493	493		14403094
X-33	F-3	1369	162.35	0.00	34.83	34.83	197.18	0	3003			3003	3003		14403094
X-8	F-4	4080	402.24	0.00	261.05	261.05	663.29	0	22504			22504	22504		14403094
X-33	F-5	54	6.40	0.00	1.37	1.37	7.78	0	118			118	118		14403094
X-33	F-6	225	26.68	0.00	5.72	5.72	32.41	0	493			493	493		14403094
X-33	F-7	1283	152.15	0.00	32.64	32.64	184.79	0	2814			2814	2814		14403094
X-8	F-8	2440	240.56	0.00	156.12	156.12	396.67	0	13458			13458	13458		14403094
X-33	F-9	340	40.32	0.00	8.65	8.65	48.97	0	746			746	746		14403094
X-18	F-11	22050	2377.91	0.00	1108.93	1108.93	3486.84	0	95597			95597	95597		14403094
X-33	F-12	1210	143.49	0.00	30.79	30.79	174.28	0	2654			2654	2654		14403094
X-33	F-17	120	14.23	0.00	3.03	3.03	17.28	0	263			263	263		14401295
X-33	F-18	720	85.38	0.00	18.32	18.32	103.70	0	1579			1579	1579		14403094
X-20	F-19	12100	1196.36	507.84	352.68	860.52	2056.89	43779	30404			74183	74183		16999863
X-21	F-20	7130	428.99	0.00	75.46	75.46	504.46	0	6505			6505	6505		07075109
T-1	AREA F-50	3190	98.37	96.05	268.98	365.03	453.40	8281	23188			31468	31468		14213153
X-33	F-171	120	14.23	0.00	3.03	3.03	17.28	0	263			263	263		14403094
TOTALS	17	56710	5412.76	603.89	2368.75	2772.64	8385.40	52060	204202			256262	256262		14786460

ALL BLDG.			MAAP ENERGY CONSUMP.			DATA						
AS IS			15 PER CENT			MOBIL. H&I LINES			1 AREA			
BLDG.			ANNUAL			ENERGY CONSUMP.			MBTU			
PROTOTYPE BLDG.	BLDG. NO.	BLDG. SQ. FT.	FUEL OIL	A/C ELEC.	LTG. ELEC.	A/C+LTG. ELEC.	TOTAL OIL+ELEC.	MBTU	BLDG.	ELEC. CONSUMP.	ENERGY	
												TOTAL SQ. FT./YR
X-33	H-6	120	14.23	0.00	3.05	3.05	17.28			263	14403094	
X-20	H-12	13800	1364.45	579.19	402.23	981.42	2345.87		49930	84606	16999063	
X-33	H-81	4110	487.40	0.00	104.57	104.57	591.97		0	9014	14403094	
X-33	H-91	120	14.23	0.00	3.05	3.05	17.28		0	263	14403094	
X-33	H-92	120	14.23	0.00	3.05	3.05	17.28		0	263	14403094	
X-33	H-102	54	6.40	0.00	1.37	1.37	7.78		0	118	14403094	
T-113	H-111	3760	117.38	107.33	229.22	336.55	453.94		9252	19761	12072751	
T-113	H-115	9796	305.82	279.63	597.20	876.83	1182.65		24106	51483	12072751	
X-33	I-1	344	40.79	0.00	0.75	0.75	4.58		0	754	14403094	
X-33	I-2	180	21.35	0.00	4.58	4.58	25.93		0	395	14403094	
X-33	I-3	225	26.68	0.00	5.72	5.72	32.41		0	493	14403094	
X-4	I-4	6304	624.06	0.00	422.71	422.71	1046.77		0	36441	16604803	
X-33	I-51	120	14.23	0.00	3.05	3.05	17.28		0	263	14403094	
X-33	I-52	120	14.23	0.00	3.05	3.05	17.28		0	263	14403094	
X-33	I-53	120	14.23	0.00	3.05	3.05	17.28		0	263	14403094	
I-3	AREA I-3	20040	1315.05	0.00	1109.05	1109.05	2424.10		0	95608	12096321	
I-3	AREA I-4	12150	797.30	0.00	672.40	672.40	1469.70		0	57966	12096321	
I-3	AREA I-5	7036	461.71	0.00	389.39	389.39	851.10		0	33568	12096321	
I-3	AREA I-6	4237	278.04	0.00	234.48	234.48	512.52		0	20214	12096321	
I-3	AREA I-7	1463	96.00	0.00	80.97	80.97	176.97		0	6980	12096321	
I-3	AREA I-8	1567	102.83	0.00	86.72	86.72	189.55		0	7476	12096321	
X-20	AREA I-23	5280	522.05	221.60	153.90	375.50	897.55		19104	13267	16999063	
I-3	AREA I-40	9617	631.08	0.00	532.22	532.22	1163.30		0	45881	12096321	
I-3	AREA I-154	1296	85.05	0.00	71.72	71.72	156.77		0	6183	12096321	
TOTALS		24	101979	7368.82	1187.75	5125.54	6313.29	13682.11	102392	441857	544249	13416592

ALT		BLDG.		MAAP		CONSUMP.		DATA			
AS IS		13 PER CENT		MOBIL.		Q AREA		S AREA		T AREA	
PROTOTYPE	BLDG.	BLDG.	ANNUAL	ENERGY	CONSUMP.	MBTU	BLDG.	ELEC.	ENERGY	TOTAL	
BLDG.	NO.	SQ. FT.	FUEL OIL	A/C ELEC.	LTG. ELEC.	A/C+LTG. ELEC.	TOTAL OIL+ELEC.	A/C KWH/YR	LTG. KWH/YR	KWH/YR	MBTU/ SQ. FT./YR
Q-23	Q-11019	38456	789.93	0.00	1410.74	1410.74	2200.71	0	121617	121617	.05722667
Q-23	Q-201023	9600	197.20	0.00	352.18	352.18	549.38	0	30360	30360	.05722667
Q-23	Q-24	2024	41.58	0.00	74.25	74.25	115.83	0	6401	6401	.05722667
Q-23	Q-251027	7200	147.90	0.00	264.13	264.13	412.03	0	22770	22770	.05722667
Q-23	Q-281032	10120	207.88	0.00	371.25	371.25	579.13	0	32005	32005	.05722667
X-21	8-31	7650	460.28	0.00	80.97	80.97	541.25	0	6980	6980	.07075109
X-20	8-32	7650	756.38	321.07	222.98	544.05	1300.43	0	19252	19252	.16999063
T-1	T-1	50481	1398.42	1520.83	4256.49	5776.52	7174.94	27679	366939	497976	.14213153
T-1	T-2	6832	189.24	205.72	576.07	781.78	971.04	131037	49661	67395	.14213153
T-1	T-10	13398	371.15	483.43	1128.70	1533.13	1904.28	17734	97388	132166	.14213153
T-113	T-113	12184	380.37	347.79	742.78	1090.57	1470.94	34778	64033	94015	.12072751
T-114	T-114	5760	113.80	273.90	1185.98	1459.88	1573.68	29982	102240	125852	.27320889
TOTALS	39	171353	5054.16	3071.94	10667.54	13739.48	18793.64	264822	919616	1184438	.10967664

ALL BLDG.		MAAP ENERGY CONSUMP.		DATA							
AS IS		15 PER CENT		X LINE							
BLDG.	ANNUAL	ENERGY	CONSUMP.	MBTU							
BLDG. NO.	BLDG. SQ. FT.	FUEL OIL	A/C ELEC.	LIG. ELEC.	A/C+LIG. ELEC.	TOTAL OIL+ELEC.	BLDG. MBTU	ELEC. CONSUMP.	E. RGY	TOTAL SQ. FT.	TOTAL MBTU/ R
X-4	4830	478.14	0.00	323.88	323.88	802.01		27920	27920	16604E	
X-7	494	58.58	0.00	12.57	12.57	71.15		1084	1084	14403006	
X-8	6550	645.76	0.00	419.08	419.08	1764.84		36128	36128	16257068	
X-12	7696	919.93	0.00	477.37	477.37	1397.29		41152	41152	18156095	
X-14	20050	1461.37	0.00	1210.02	1210.02	2671.39		104312	104312	13323644	
X-33	120	14.23	0.00	3.05	3.05	17.29		263	263	1440462	
X-18	15000	1833.31	0.00	854.96	854.96	2688.27		73703	73703	17921767	
X-19	640	75.90	0.00	16.28	16.28	92.18		1404	1404	14403098	
X-20	15500	1532.53	650.55	451.78	1102.33	2634.85	56081	38947	95028	16999037	
X-21	13700	824.29	0.00	145.00	145.00	969.28		12500	12500	07075070	
X-27	7050	630.71	0.00	360.47	360.47	991.18		31075	31075	14059284	
X-41	17408	1707.46	87.18	1299.21	1386.39	3093.85	7515	112001	119516	1777251	
TOTALS	12	109038	10182.19	737.72	5573.66	6311.39	16493.58	63597	48188	54485	15126449

The first table shows energy savings for the various ECAM project groupings of buildings.

The second table shows the results of computer run composite project energy savings, when performed on insulated buildings, with and without temperature controls added.

E	LINE OR AREA	C		A		M		S		A		V		I		N		G		S	
		ROOF		INSULATION		WALL		INSULATION		REDUCED		FENESTRATION		ATC		MODIFICATIONS					
		FUEL MBTU	KWH	TOTAL MBTU	FUEL MBTU	KWH	TOTAL MBTU	FUEL MBTU	KWH	FUEL MBTU	KWH	TOTAL MBTU	FUEL MBTU	KWH	TOTAL MBTU	FUEL MBTU	KWH	TOTAL MBTU	FUEL MBTU	KWH	TOTAL MBTU
B - LINE		3548	9283	3656	1923	8590	2023	531	1580	549			1490	16895	1686						
X - LINE		3544	0	3544	2369	8591	2469	669	1581	687			2449	16880	2644						
ALL OTHER LINES & AREAS																					
D - LINE*		1933	11320	2064	1052	10475	1173	175	1927	197			810	20601	1049						
D - AREA		0	0	0	0	0	0	0	0	0			34	1	34						
F - AREA		0	0	0	0	0	0	0	0	0			23	1	23						
H - LINE*		854	8265	950	635	7648	724	69	1407	86			534	22456	794						
I - AREA		0	0	0	0	0	0	0	0	0			1584	5756	1651						
J - AREA*		282	0	282	423	0	423	136	0	136			1024	10733	1148						
K - AREA		0	0	0	0	0	0	0	0	0			889	0	889						
O - LINE*		1502	2489	1531	331	2303	358	62	424	67			428	4529	481						
Q - AREA		0	0	0	0	0	0	0	0	0			439	0	439						
T - AREA		0	0	0	0	0	0	0	0	0			618	6677	695						
V - LINE		0	0	0	0	0	0	0	0	0			202	6345	275						
TOTAL OTHER FUEL OIL COAL		4571	22074	4827	2441	20426	2678	442	3758	486			6585	77099	7478						
		0	0	0	0	0	0	0	0	0			3789								
		4571			2441			442					2796								
TOTAL ALL PROJECTS FUEL OIL COAL		11663	31357	12027	6733	37607	7170	1642	6919	1722			10524	110874	11808						
		7092			4292			1200					7728								
		4571			2441			442					2796								

COAL FUEL SOURCE IS INDICATED BY AN * - ALL OTHER LINES & AREAS HAVE FUEL OIL AS A HEATING SOURCE

LINE OR AREA	ECAM		SAVINGS		
	COMPOSITE SAVING - ROOF, GLASS, WALL, ATC MODIFIC		SAVINGS ATTRIBUTABLE TO GLASS, ROOF, WALL MOD ONLY		
	FUEL MBTU	KWH	FUEL MBTU	KWH	TOTAL MBTU
B - LINE	4720	22899	3230	6004	3300
X - LINE	5690	17043	3241	163	3243
ALL OTHER LINES & AREAS					
D - LINE*	2501	27923	1491	7322	1775
D - AREA	34	1	0	0	0
F - AREA	23	1	0	0	0
H - LINE*	1318	25059	784	2603	815
I - AREA	1584	5756	0	0	0
J - AREA*	1175	6762	151	0	105
K - AREA	889	0	0	0	0
O - LINE*	1463	6139	1035	1610	1054
Q - AREA	439	0	0	0	0
T - AREA	618	6677	0	0	0
V - LINE	202	6345	0	0	0
TOTAL OTHER FUEL OIL COAL	10247 3789 6458	84664	3662 0 3662	11536	3750
TOTAL ALL PROJECTS FUEL OIL COAL	20656 14198 6458	124606	10132 6471 3662	17703	10293

COAL FUEL SOURCE IS INDICATED BY AN * - ALL OTHER LINES & AREAS HAVE
FUEL OIL AS A HEATING SOURCE

APPENDIX C
LIST OF REPORTS

LIST OF REPORTS

ENERGY USE SURVEY

Narrative - Volume I, Section 3

Supporting Data - Volume II and III

ENERGY MONITORING AND CONTROL SYSTEMS

Narrative - Volume I, Section 4

Supporting Data - Volume II

BIOMASS SURVEY

Narrative - Volume I, Section 5

Supporting Data - Volume III

BASEWIDE ENERGY PLAN RECOMMENDATIONS

Volume I, Section 6

ECAM PROJECTS BROCHURES

Volume I, Section 7